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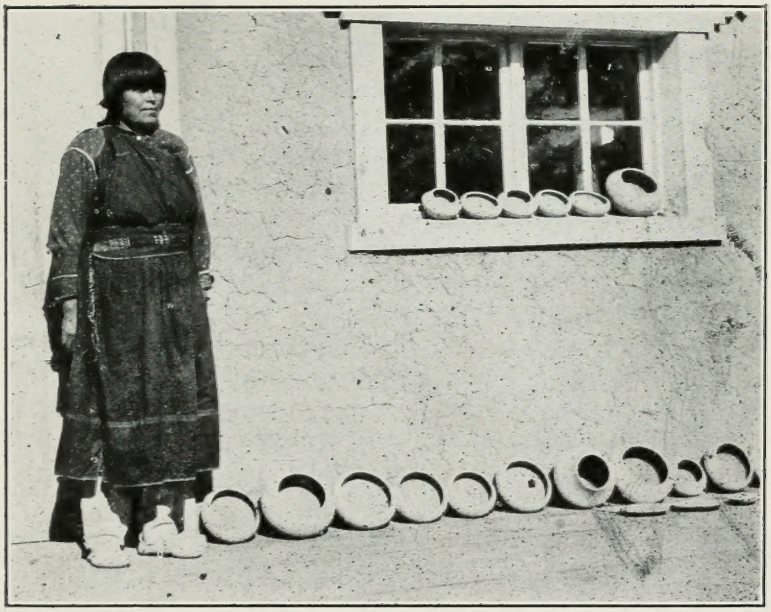

MARIE MARTINEZ AT SAN ILDEFONSO

CERAMIC PIGMENTS OF THE INDIANS OF THE SOUTHWEST[1]

The chemical nature of the coloring matter used by the ancients as ceramic pigments has been definitely established in a great many instances, but the small quantities available for analysis have frequently served as a barrier to their identification. As a matter of fact, the literature on this subjects is very meager. The Encyclopaedia Britannica states that all the black pigments ordinarily used contain carbon as the principal constituent. They are ivory black, lamp black, charcoal black, india ink and graphite (sometimes called black lead or plumbago). The same publication[2] in an article on Italian ceramics after the year 1200 A. D. states that black was made from a mixture of various colors. These included antimonate of lead for the yellow, ferric oxide for the red, copper oxide for the green, oxide of cobalt for the blue and manganese for the brownish purple.

Robbins, Harrington and Freire-Marreco[4] state that the modern Tewa Indians use a black paint for the decoration of pottery made from the

1. From the Department of Chemistry, University of Colorado, Boulder, Colorado.

2 Encyclopaedia Britannica, 21, 598 (1914).

3. Encyclopaedia Britannica, 5, 737 (1911).

4. "Ethnobotany of the Tewa Indians," Bureau of American Ethnology, Bulletin 55, 58 (1916).

Rocky Mountain bee plant or guaco (peritoma serrulatum). Wissler,[5] while speaking of the Indians of the Southwest, says, "Here we find the paint of both vegetable and mineral origin, the reds and yellows from iron, the blacks from the juices of plants. By proper firing, the desired colors could be made permanent." Wissler was here no doubt referring only to the Indians of today, although his statement has been interpreted as referring to the prehistoric Indians as well. Watson[6] has studied the modern art of the making of pottery of the Tewa Indians, and states that the black pigment is obtained by boiling down the juice of the bee plant until it becomes black and thick. After the dried unburned utensils have been decorated with this liquid, they are fired by placing them on stones in the middle of a bed of coals, piling flat pieces of manure around and over them, and leaving them there for about an hour. They are then polished by rubbing grease over them before they are cold. At the museum of the American Indian in New York there is on exhibit a long neeedle cactus. Near it is a tube containing a thick black liquid which is indicated as coming from it and as being used in decorating pottery by the Indians of the Southwest. The mode of preparation is no doubt the same as in the case of the paint of the bee plant. Various authorities have questioned the possibility of such

5. "The American Indian," Clark Wissler, 72 (1917).
6. *Art and Archaeology*, 9, 24 (1920).

organic coloring material being used and withstanding the temperature of firing. However, such arguments could not be advanced in the case of the firing at such low temperature as the Tewas of to-day use.

The fact that present-day Indians use a black of vegetable origin has apparently caused investigators to lose sight of the work of Nordenskjold,[7] who made a rather extensive study of the pigments used by the cliff dwellers. A qualitative analysis led him to believe that the red pigment was the iron sesquioxide Fe2O3. He states that the red and yellow colors come from iron ochers prepared in stone mortars, the various shades being the result of various degrees of burning. Nordenskjold found a large spherical vase at the Step House in the Mesa Verde whose decoration was so thick that he could scrape off enough for analysis. It was found to be an iron base and he concluded that it was probably the magnetic oxide Fe3O4. He also states that in one of the ruins he picked up a piece of wood several centimeters long, at the end of which there was still attached a reddish substance, which he analyzed. It was found to be a resin mixed with iron ocher. He thus explained that this resin reduced the red oxide to the black oxide.

Kidder and Guernsey[8] in their report on ar-

7. Nordenskjold. "The Cliff Dwellers of the Mesa Verde," Stockholm, 1893.

8. Bulletin of the Bureau of American Ethnology, 65, 130 (1919).

chaeological explorations in northeastern Arizona state that the pigment is a clear dull black, with a slightly bluish or slaty cast. No analyses were made, but they assumed it was an iron product as determined by Nordenskjold.

Several years ago Mr. Earl H. Morris, who was at that time curator of the Aztec Ruin National Monument, asked the author to determine the composition of the black pigment used by the Chaco and Mesa Verde Indians. For this work he furnished a box of potsherds which were in a very good state of preservation.

The best method of removing the thin layer of coloring matter was found to be by means of hydrofluoric acid. This loosened it to such an extent that it could be very easily washed off. Comparative analyses were made of both the pigment and the body of the pottery. Manganese, which might have been responsible for the color, was found to be lower in the pigment than in the clay. The most prominent element in the surface was iron. After considerable effort it was found possible to scale off thin flakes of the black pigment, which were magnetic and which became non-magnetic on heating in the oxidizing flame. Conversely, a potsherd covered with a bright red pigment, blackened on heating in the reducing flame, while becoming magnetic. One piece of red pottery was found blackened on the under side. It looked as if it had been smoked up over

a fire, but this was not the case, as the black was magnetic. It was either the result of the reducing gases which were present at the bottom at the time of firing or at some later time while in use over an open fire.

One of the potsherds with a black design was fired in a furnace at about 1,000° C., with the result that the design became a dull red on a lighter background, showing that the original firing must have been at a comparatively low temperature.

It is therefore evident that the black pigment of the prehistoric Indians of the Southwest was the sesquioxide of iron, commonly known as magnetite, while the red pigment was the mineral hematite.

The use of the two oxides of iron for the production of black and red pigment, as well as the control of the processes of oxidation and reduction is to be regarded as a rather notable scientific achievement of the Indians.

It is also interesting to note that the use of hematite as the cheap barn paint of to-day must date back to very early times.

The author wishes to take this occasion to thank Mr. O. B. Muench for his assistance in making some of the analyses, and Dr. E. B. Renaud for some of the literature references.

FRANK E. E. GERMANN
CORNELL UNIVERSITY

In Science

WESTERN EXTENSION OF EARLY PUEBLO CULTURE

It has been known for some time that the remote ancestors of our present Pueblo tribes, at a very early period when their characteristic culture was beginning to take form, were widely distributed over a vast territory, many times larger than their domain when first visited by the Spanish explorers in the sixteenth century. The map presented by Dr. A. V. Kidder in his *Introduction to the Study of Southwestern Archaeology* (1924), which embodies the latest knowledge of the subject, shows these ancient people spread out over large portions of New Mexico, Arizona, and Utah, occupying as well a small part of southern Colorado, and a little slice of Nevada embracing the Muddy and Virgin River valleys. Little was known of this Nevada occupancy, however, beyond the fact that pottery fragments of Pueblo type had been occasionally seen along these streams, until the discovery of Pueblo Grande de Nevada, near St. Thomas, shed new light on the subject.

The finding of this veritable city of early Pueblo dwellings and its excavation by a Museum expedition under the writer's direction, furnished the opportunity, as well as a base of operations,

for several little exploring trips into the surrounding country, the results of which are worth recording in that they indicate an extension of the early Pueblo domain farther west and northwest than is shown on Kidder's map or by any record thus far seen by the writer.

These excursions soon revealed the fact that Puebloan pit-dwellings and adobe ruins are scattered along the entire length of Muddy river from its junction with the Virgin to its source some miles above the Moapa Paiute reservation, and dotted along the Virgin river from the Colorado back upstream to the State line, and doubtless beyond.

The oldest type of house in this region seems to be the pit-dwelling, with which are usually associated fragments of plain and corrugated Pueblo pots and jars, with a few pieces of gray bowls on which geometric designs have been drawn in black directly on the surface of the clay composing the bowl, without the application of a white slip. All these types of ware are associated with the apparently later adobe ruins, with the addition of bowl-fragments bearing designs in black over a white slip, and pieces of bowls and jars of solid red with decoration in black.

Sometimes seen on the surface of pueblo sites, but usually on camp-sites showing no trace of dwellings of any kind, is still another sort of pottery—dark-brown or black in color, coarse,

granular, and rather soft in texture, and irregular as to thickness and surface. When decorated at all it bears merely lines of finger-nail impressions, and many of the vessels seem to have been conical in form, with pointed bottoms—very different from most Pueblo ware. This pottery we have been able to identify as of Paiute origin, and we learned from the Indians that such vessels were manufactured by the Moapa band as late as 1890.

Searching for traces of Pueblo culture outside of the Muddy and Virgin valleys, we found characteristic pottery of all types, except the black-on-red, near Las Vegas, sixty-odd miles southwest of St. Thomas; while at Indian Springs, about fifty miles northwest of Las Vegas and seventy-five miles west of St. Thomas, most of the Pueblo varieties have been picked up. This is the western-most point at which we found traces of Pueblo culture—only fifty miles from the California line, and but little farther from Death valley. Our examination of favorable places farther west, so far as they went, revealed a little pottery, but this was of Paiute, not Pueblo, type.

Up to the present writing we have not conducted explorations south of Las Vegas, but it it quite likely that such would reveal Pueblo traces nearly to the California line, if not in California itself.

Proceeding northward from St. Thomas we find Pueblo pottery reported from at least one place on the Meadow Valley wash between Moapa and Caliente, and continuing still farther north we have similar reports from the vicinity of Pioche, including one find at Rose Valley, near the Utah line.

In the spring of 1925, at the request of Governor Scrugham, we made a trip to Baker, Nevada, about 175 miles north of St. Thomas in a direct line, to visit some caves. We had no expectation whatever of seeing anything of a Pueblo character north of Pioche, so we were astonished when shown typical Pueblo corrugated and plain pottery found in a rockshelter at Garrison, near Baker; and at the Bishop ranch, twenty-five or thirty miles north of Baker, pieces of a characteristic early Pueblo pitcher with a handle and various plain fragments of pottery, all dug up in cleaning out a large spring on the ranch. Mr. Bishop also reported what he took to be a ruin in the neighborhood.

Later, while exploring a cave near the mouth of Smith Creek cañon, only a few miles from the Bishop ranch, several pieces of black-on-gray Pueblo ware appeared, together with some corncobs preserved by the dryness of the cave. This was the farthest point northwest at which we actually saw Pueblo pottery, although an Indian

reported finding some fragments twenty or thirty miles still farther north.

It should be noted here too that the corn-cobs mark an extension of aboriginal agriculture farther northwest than anything hitherto reported, so far as the writer knows.

How much farther Pueblo culture, or the beginnings of it, may extend, additional work alone can determine. Certain it is that in the few days we were able to give to reconnoissance, we added to the known domain of the early Pueblos a strip of Nevada about 250 miles long from north to south and about eighty miles wide from east to west at the widest point, traced the people to within fifty miles of the California line, and established a new northwestern limit for the cultivation of corn in ancient North America.

M. R. HARRINGTON IN
INDIAN NOTES

CEREMONIAL SHIELDS OF TAOS

The pueblo of Taos in northern New Mexico has preserved its ancient customs to an unusual degree, largely because it has persistently resisted interference with its esoteric beliefs, which are guarded with great secrecy. For this reason it is not often that ceremonial objects find their

way out of tribal keeping, hence the shields herein referred to may be regarded as of unusual ethnologic interest.

According to the information available, until about the year 1855 the Taos Indians held a scalp dance after the return of their warriors from a hostile expedition. This ceremony was conducted on an island formed by the little stream that flows by Taos and divides below the pueblo. On the island were two large cottonwood trees, beneath which the dance was held, and their stumps are still standing. This island is regarded as sacred ground.

It seems that the performance of the scalp ceremony was a function of the Sun clan,[1] and when held, the nine shields to be described were each attached to a pole, the poles being set upright in the ground in the form of a large circle. There are two kind of shields, as follows:

(I) Five almost identical examples, to which the scalps of women are believed to have been attached, approximate eleven inches in diameter. Each consists of two discs of yucca matting bound to a hoop forming the rim, each disc being covered on one side with tanned deerskin and the pair set face to face in such manner that, bound

1. According to the informant; but as Taos does not have a clanship system, possibly the Sun House People, a division of the Day People, one of the six ceremonial groups of the tribes as recorded by Curtis (*North American Indian*, vol. XVI, in press) is intended.

with an edging of deerskin stitched with a thong of the same material, they form a pocket with an opening of an inch and three-quarters at the upper margin. Thrust into this opening are two slightly flattened or squared sticks, nine to ten inches in length and notched near the outer end. In the notch of each of two of the pairs are remains of fiber cord, while one of another pair has a short deerskin thong by which it is tied to the shield rim. The purpose of these sticks is not known. A deerskin loop was provided at the small aperture of each shield, evidently for suspension, although the loops have disappeared from three of them. At the rims of three of the five shields are attached other deerskin thongs or their remnants, to which possibly feathers were once fastened. All the shields are painted green, probably some cupreous product such as the Zuñi hold so sacred and which they call *ákwahli* ("medicine-blue").

In the middle of one shield attached to what may be called the scalp thong, is an *Olivella* shell, and a similar shell is tied loosely at the small marginal opening—magic missiles of Pueblo warchiefs in their mythical strife against sorcerers. This shield is provided with only one notched stick, but, unlike the other shields, there is attached to its rim, at the opening, a deerskin pouch resembling a finger-stall in which fits a tube,

three and half inches long, formed of the hollow stem of some plant, while a similar tube is thrust into the pocket between the two faces of another of the shields, as if each of the five had once been provided with one. Possibly another tiny deerskin bag, stained yellow and containing no trace of paint within, may have contained this tube, although the objects were found dissociated.

(2) The other four shields, which are said to have been used in connection with the scalps of men, are of the same size as the others, with the exception of one, which is slightly smaller. Unlike the "women's" shields, they consist of a single disc of yucca matting bound to a hoop covered with deerskin. Three of the four still retain the central thong. Green paint remains on all, and two still have their suspension thongs.

Accompanying the nine shields, which were contained in a very old bag rudely made of tanned buffalo-skin, are a small deerskin pouch containing fine, dark-red sand, and two small stuffed rings of tanned deerskin, one colored red, the other green like the shields. These rings are said to have been used in the process of stretching the scalps before drying.

F. W. Hodge in Indian
Notes For April 1926.

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PAUL A. F. WALTER, EDITOR.

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IT IS WRITTEN

TERTIARY BEAR AND MASTODON IN SANTA FE MARLS

A bulletin of the American Museum of Natural History deals with the extinct genera, Hemicyon, Dinocyon, Hyaenarctos and Ursavus. A number of new or little-known species are described, the published species are revised, and the affinities of the group and of its several genera are discussed on the basis of a restudy of the classic material in certain European museums and upon rich new evidence secured during the writer's (Childs Frick) researches in the Pliocene and Miocene of California, and the Miocene of

New Mexico and Colorado. It is the nearly complete skeleton of Hemicyon (Canis) ursinus in the Santa Fe Miocene, which furnishes evidence for the "most interesting revelations of recent palaeontological research" to wit: "that Hemicyon as well as Hyaenarctos was represented in the Western World." The frontispiece, one of many illustrations, pictures the skull and jaws of the skeleton found in the Santa Fe marls, a few miles north of the Tesuque Divide. Says the author: "Late in the season of 1924, in the hope of securing representative material of the Santa Fe form, we determined to send a Museum party into the historic New Mexican locality. The deposits of the Santa Fe area, at present so famed through archaeological discoveries, had lain palaeontologically untouched since Cope's hurried work of 1874. The occasion was opportune and the attempt well-timed, for on the fifth day of their reconnaisance Messrs. Charles Falkenbach and G. G. Simpson, of our party, had the great good fortune to come upon the magnificent skull and skeleton noted above. Curiously enough this was the one and only specimen of Hemicyon found during some nine weeks in the field. This splendid and unique trophy, which the storms and disintegration of another season might have utterly destroyed, has greatly increased our knowledge of this genus, the characters of the skull and skeleton of which have heretofore been unknown." The bulletin of 120 pages with several

insets and 63 figures, is a valuable contribution to palaeontological knowledge.

Another bulletin, also by Frick, describes the "Tooth Sequence in Certain Trilophodont Tetrabelodont Mastodons". "A tendency to extraordinary enlargement of the posterior molars at the expense of the more anterior teeth pervades the Proboscidea. The present paper discusses two resulting and extremely different types of tooth sequence and their bearing on tooth homology and the peculiar problem of tooth succession in this order. These types are exampled in two trilophodont forms secured during the course of the author's investigation of the Miocene deposits of Santa Fe, New Mexico, and the Pliocene deposit of the Eden, California. The paper further describes a new species of American trilophodont based on remains of great size occurring among the rich series from the former horizon and a very remarkably preserved skull here considered as representing a paratype of this species."

"Leidy, in 1873, described under Mastodon obscurus and M. shepardi some mastodon remains collected from the vicinity of Santa Fe by Governor Arny of New Mexico, stating 'I think it probable, without being positive in the matter, that the mastodon remains above described (that is, these New Mexican specimens and others from

Maryland and California) which have been referred to species under the names of Mastodon obscurus and M. shepardi, including those from New Mexico, belong to one and the same species. . a near relation of the Mastodon augustidens of Europe.' Cope, in 1874, noted that mastodon remains from Santa Fe represented a new species for which he proposed the name Mastodon productus, and took for the type a manibular specimen which he had but recently found. Our work in the Santa Fe region has resulted in the obtaining of considerable collection of mastodon material. Among this are immature specimens illustrative of various stages of the milk and replacement dentition, and a fine series of mature specimens that differ widely in size and in the degree of prolongation of the symphysis, and moderately in the tubercular arrangement of the teeth."

MUSEUM EVENTS

Dr. Ashby's Visit

Dr. Thomas Ashby of the British School of Archaeology, at Rome, Italy, one of the lecturers this year of the Archaeological Institute of America, addressed the Santa Fe Society and its friends on Sunday afternoon, May 16, choosing for his subject: "Roman Roads; the Arteries of

The Empire". The lecture was illustrated and the speaker alluded to similarity of tufa and lime stone road material in New Mexico to that of central and southern Italy. After the lecture, the Woman's Museum Board served tea. Dr. Ashby made trips to the Rito de los Frijoles and to the Pecos ruins, before leaving for Kansas City, where he had his next lecture date.

New Pictures

Gustave Baumann has placed on exhibit a landscape that is unusual for more than one reason. While the Museum has had several exhibits of his wood-block color prints it is some time since he has exhibited a large painting from his brush. It is a mountain scene that gives the impression of vastness of tawny-colored slopes upon which rest forests of ever-greens and nestle lakelets of blue--a composition as impressive as it is charming. Fremont Ellis displays four landscapes in which he plays with light in characteristic dramatic vigor. Miss Caroline Pickard has new studies of the Frijoles Canyon that are interesting because they depict in lovely manner scenes that are sought by tourists who seek that which is "different" in the Santa Fe section.

The Bradfields Leave

After many years of residence in Santa Fe, Mr. and Mrs. Wesley Bradfield left the last week in

May for San Diego, where Mr. Bradfield will assume an administrative position with the San Diego Museum. He will not sever his connection with the staff of the Museum of New Mexico and School of American Research for which he has done notable work, in the way of photography, museum installation, and of late years, archaeological research, his excavations and studies on the upper Mimbres, especially, having been epoch-making. Mr. Bradfield has prepared considerable material for publication and his transfer to San Diego will give him the opportunity to look after this, although he will not discontinue his work on the prehistoric sites of southwestern New Mexico. It is at San Diego that his casts of the Maya monuments at Quirigua are installed in the California Building, and he is no stranger in that City where during the Panama-Pacific Exposition and since he has spent considerable time and in addition to doing museum work has lectured repeatedly.

IN THE FIELD

Excavations In The Chaco

The National Geographic Society will supplement its excavations of Pueblo Bonito and at Pueblo del Arroyo by work this summer on Pueblo Alto and Penasco Blanco.